EE115A Analog Circuits @ ShanghaiTech

Fall, 2024

Instructor: Haoyu Wang
Class Hours: Mon. & Wed. (Even week) 8:15am-9:55am; Room 1D-106, SIST BLDG
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Office Hours: Friday 3:00pm-5:00pm; other times by appointment
Course Website: https://pearl.shanghaitech.edu.cn/teaching/2023fall/EE115A/
Gradescope: https://www.gradescope.com/courses/811371
Forum: QQ group 812505083.

Course Description:

Analog Circuits is a fundamental course required for students majoring in Electronics and Information Engineering. It covers the characteristics of common semiconductor devices and methods for analyzing and designing analog electronic circuits.

This course aims to equip students with the basic theory, methods, and skills of analog electronic technology. Students will gain an overview of the development of analog electronic technology and a foundational understanding necessary for subsequent courses.

Students will master the basics of analog circuits, including the fundamentals of analog signals, operational amplifiers, semiconductor principles, MOSFETs, single-stage amplifiers, differential amplifiers, and multistage amplifier analysis and design.

Prerequisite(s): Circuits Theory

Credits: 3 credits, 40 lecture hours, 24 lab hours

Required Text:

-Sedra and Smith, *Microelectronic Circuits*, 8th Edition, Oxford Press, 2020. ISBN 9780190853464

Recommended Texts:

The following textbooks will provide advanced guidance for this course.

-童诗白, 华成英, 模拟电子技术基础, 第 6 版, 高等教育出版社, 2023. ISBN: 9787040595338
-Behzad Razavi, *Design of Analog CMOS Integrated Circuits*, 2nd Edition, ISBN 9780072380323

Course Material: Most of the course material will be delivered within the lecture. Supplementary material, such as course notes, homework, and project announcements, will be updated on the class website.

Homework: Homework will be given roughly every other week. They will be released from the webpage. Homework will typically be due one week after it is posted and will be collected in Gradescope.

Late Policy: Late homework is allowed five days maximum after its due date, but its weight will be deducted by 20% per day.

Exams: Your exam score in the class will be based on two exams, scheduled for weeks 9 and 15.

Project: Students are also responsible for a simulation project. You will work individually to design, analyze, and simulate an analog circuit with certain functionality.

Grading: Grading will be based on: homework (15%), mid-term exam (20%), project (20%), final exam (20%), lab (20%), attendance (quizzes) (5%). Scores will be curved into final grades at the end of the semester.

Lecture Content

No.	Chapter	Key Concepts	Hrs
1	Signals and Amplifiers	Lecture: Characteristics of analog signals, amplifier principles, and parameters, circuit models, frequency response	2
2	Operational Amplifiers	Lecture: Analysis of ideal and non-ideal op-amps, differential amplifier analysis, integrator and differentiator circuits, DC bias, offset voltage, large-signal analysis; Labs 1&2: op-amp	6
3	Semiconductor Basics	Lecture: Intrinsic and doped semiconductors, current analysis in semiconductors, pn-junction principles; Labs 3&4 pn junction	4
4	MOSFET Transistor Basics	Lecture: Structure and working principles of devices, current-voltage characteristics, body effect, non-ideal effects	2
5	Single-Stage Amplifiers	Lecture: Principles and parameters of single-stage amplifiers, small-signal models, common-source, common-gate, common-drain amplifier analysis, bias circuits, frequency response; Lab 5&6 MOS Transistors	6
6	Basic Modules of Analog ICs	Lecture: Current sources and mirrors, voltage gain units, common-source and common-gate amplifiers	6
7	Differential and Multistage Circuits	Lecture: Analysis of common-mode and differential-mode responses, small-signal and large-signal analysis, common-mode rejection ratio, DC offset, multistage amplifier analysis	6
8	Frequency Response	Lecture: High-frequency transistor models, high-frequency response of CS amplifiers; Labs 7&8 MOS amplifier	2
9	Feedback	Lecture: Feedback mechanisms, characteristics of negative feedback, amplifier analysis based on feedback loops, stability analysis of feedback systems, frequency compensation	4

Academic Dishonesty: Academic dishonesty will not be tolerated in this course. The following acts of academic dishonesty are prohibited: cheating, fabrication, facilitating academic dishonesty, and plagiarism. Academic dishonesty includes copying homework or deliberately taking unfair advantage of the other students in the course. Once found, it can lead one to a failing grade and will be referred to the academic committee in the School of Information Science and Technology.